Attachment 15

LANDFILL 5
GROUNDWATER SAMPLING AND ANALYSIS PLAN

Contents

Tables

Figures

Acronyms

°C	degrees Celsius
BQAPP	Basewide Quality Assurance Project Plan
CoC	Chain-of-Custody
DO	dissolved oxygen
ERPIMS	Environmental Resources Program Information Management System
HAFB	Hill Air Force Base
ID	identification
IWTP	Industrial Wastewater Treatment Plant
LCL	lower confidence limit
LDR	land disposal restrictions
LF5	Landfill 5
MCL	maximum contaminant levels
ORP	oxidation reduction potential
PCBs	Poly-Chlorinated-Biphenyls
PPE	personal protective equipment
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act (RCRA)
UAC	Utah Administrative Code
UCL	upper confidence limit
UDEQ	Utah Deparment of Environmental Quality
USEPA	United States Environmental Protection Agency
USGS	United States Geological Society
UTTR	Utah Test and Training Range
VOCs	Volatile Organic Compounds

LANDFILL 5 GROUNDWATER SAMPLING AND ANALYSIS PLAN

1.0 Introduction

This Sampling and Analysis Plan (SAP) describes the groundwater sampling methodology for Landfill 5 (LF5) located at the Utah Test and Training Range (UTTR). The SAP has been prepared to fulfill requirements of Module V of the Resource Conservation and Recovery Act (RCRA) Permit for the Landfill 5 at the UTTR. The SAP was developed to ensure that sufficient samples are taken to draw statistical conclusions concerning potential contamination and to statistically demonstrate the migration potential of all waste constituents. Where applicable, the procedures and Quality Assurance/Quality Control (QA/QC) techniques in the current version of the Basewide Quality Assurance Project Plan (BQAPP), which is based on the USEPA Test Methods for Evaluating Groundwater Contamination, are used.

2.0 Landfill 5 Description

2.1 Site History

Landfill 5 is a hazardous waste disposal facility that was operated under interim status guidelines in compliance with Chapter 7 of the Utah Hazardous Waste Management Rules [now Rule R315, Utah Administrative Code (UAC)]. A wide variety of wastes generated at Hill Air Force Base (HAFB) including chlorinated and non-chlorinated solvents, heavy metals, Poly-Chlorinated-Biphenyls (PCBs), paints and paint strippers, Industrial Wastewater Treatment Plant (IWTP) sludge, cadmium-contaminated blast media, mercury, asbestos, and many other wastes were deposited in the landfill between 1976 and 1983. Landfill 5 was operated prior to land disposal restrictions (LDR) which now prohibits the disposal of liquid hazardous waste in landfills.

2.2 Site Description

The Landfill 5 site is located in the northwest corner of Utah, just west of the Great Salt Lake. Figure 1 shows the location of Landfill 5. The landfill is located at the extreme north end of Sink Valley in the eastern section of the UTTR, approximately 5 miles northwest of the Oasis Range Complex. LF5 is located in T5N, R9W, Section 30, an area of unsurveyed land.

Figure 2 shows the layout of Landfill 5. The landfill consists of six cells which are 90 feet wide by 150 feet long by 15 deep. These cells were excavated into a light-gray alkaline silty-clay loam. The location of the landfill was chosen because of the low soil permeability, low annual precipitation, high evapotranspiration, and remoteness of the site.

3.0 Sampling Locations

Groundwater samples will be collected from a set of four (MW-G, MW-H, MW-I, and MW-J1) monitoring wells surrounding Landfill 5 and are shown in Figure 2. Historical groundwater data collected from these wells and the Conceptual Site Model developed for Landfill 5 suggest that groundwater beneath the landfill flows in a north to south direction (CH2M HILL, 2001).

Based on the flow of groundwater beneath Landfill 5, monitoring well MW-G will be used as the upgradient well, monitoring wells MW-I, MW-J1, and MW-H will be used as the down gradient wells, providing one up- and three down-gradient monitoring wells.

4.0 Hazardous Constituents/Indicator Parameters to be Monitored

The analytical methods listed in the 1988 Sampling Plan are outdated. However, the United States Geological Society (USGS) has been using updated analytical methods for the sampling events. Table 1 lists the analytical parameters and United States Environmental Protection Agency (USEPA) test methods presented originally in the LF5 Closure/Post-Closure Plan, the analytical methods currently being used by the USGS for semiannual groundwater monitoring, and the current updated USEPA test methods.

The current list of groundwater analytical parameters used by the USGS for Landfill 5 is extensive and has been reduced to provide a similar level of protection at a reduced cost to HAFB. As suggested in the Response to UDEQ Comments to RCRA Comprehensive Groundwater Monitoring Evaluation Report for Landfill 5 of the Utah Test and Training Range (2001), volatile organic compounds (VOCs) typically migrate faster than semi-volatile compounds (SVOCs) and metal constituents, and therefore are the earliest indicators of contamination reaching the aquifer. Therefore, the list of analytes has been reduced by eliminating many of the slower migrating compounds such as SVOCs and metals. The updated analytical methods are summarized in Table 1.

Currently, none of the listed compounds have been detected in monitoring wells at Landfill 5. Due to the low permeability of the soils, the nature of the subsurface geology, and the low annual precipitation, the detection of such compounds is not expected. However, in the event of a detection(s) of any of the listed compounds, the Utah Department of Environmental Quality (UDEQ) will be immediately contacted and a re-evaluation of the existing groundwater monitoring program will be conducted.

5.0 Schedule

Groundwater sampling has been conducted at Landfill 5 on a semi-annual basis in Monitoring Wells MW-G, MW-H, MW-I, and MW-J1. Given the depth to groundwater and the low rate of migration due to restrictive site conditions, semi-annual groundwater sampling has been deemed adequate for the monitoring program at Landfill 5 and will continue for the foreseeable future.

6.0 Procedures

This section describes the procedures that will be used for groundwater measurement, sampling, and analysis. Sample collection and measurement with the associated field and analytical procedures are described in this section.

6.1 Introduction

Monitoring points will generally be sampled in accordance with the Basewide Quality Assurance Project Plan (BQAPP). Groundwater samples will be obtained using dedicated Grundfos submersible sampling pumps that are in place at all monitoring points at LF5 to purge and

sample the monitoring points. Table 2 summarizes well construction and equipment information for the LF5 monitoring wells.

Submersible pumps are commonly used in deep monitoring wells for compliance sampling. The monitoring wells at LF5 are equipped with 4-inch submersible Grundos groundwater sampling pumps. Blasland, Bouch & Lee, Inc. and the University of Waterloo (Gass, 1991) conducted a study that compared volatile organic results using a 2-inch Grundfos submersible pump to control samples. The results showed that there were no statistically significant losses in organic compounds when using the Grundfos submersible pump. The results indicate that the sampling pumps in place at LF5 are appropriate.

6.2 Documentation

Field documentation serves as the primary foundation for all field data collected that will be used to evaluate the site. All field documentation shall be accurate, legible, and written in indelible ink. Absolutely no pencils or erasures shall be used. Incorrect entries in the field books, logs, or on forms that need to be deleted shall be crossed out with one line, initialed, and dated. Skipped pages or blank sections at the end of a page shall be crossed out with an "X" covering the entire page or blank section; "No Further Entries," initials, and date shall be written by the person making the correction. The responsible field team member shall write his/her signature, date, and time after the day's last entry.

To further assist in the organization of the field books, logs, or forms, the date shall be recorded on top of each page along with the significant activity description (e.g., boring or well number). In addition, all original field documentation shall be retained in the project files. The descriptions of field data documentation given below serve as an outline; individual projects may vary in documentation requirements.

6.2.1 Field Logbooks

The field logbook shall be a bound, weatherproof book with numbered pages, and shall serve primarily as a daily log of the activities carried out during the investigation. The logbook shall serve as a diary of the events of the day. The groundwater sampling team members shall be responsible for recording the following information.

Health and Safety Activities

- Personnel contamination prevention and decontamination procedures
- Record of daily tailgate safety meetings
- Weather
- Calibration of field equipment
- Equipment decontamination procedures
- Personnel and subcontractors on job site and time spent on the site
- Disposal of contaminated wastes [personal protective equipment (PPE), paper towels, visqueen, etc.]
- Site name, well number

- Water levels [time and datum that water levels are measured (i.e. top of casing)].
- Purging of the well (include calculations, well volumes) with the following information:
  - Measured field parameters (temperature, pH, conductivity, odor, color, cloudiness, etc.)
  - Amount of water purged
  - Purge water disposal/containment (Baker tank/ drums, number used, identification, etc.)
- Well sampling

  Number of samples collected and type of containers used

  Date and time of sample collection

  Type of analyses

  Quality Assurance/Quality Control (QA/QC) samples collected; names given to blind samples

  Field observations

  Problems encountered and corrective actions taken

  Deviations from the sampling plan

  Site visitors

6.3 Pre-Sampling Procedures

Upon arrival at the well, prior to groundwater measurement, purging or sampling, the sampling personnel shall document any signs of tampering or well deterioration. A depth to groundwater measurement shall be taken using a non-dedicated electronic water level indicator. These measurements shall be recorded in the field logbook or on a field form.

6.3.1 Static Groundwater Elevation Measurement

Unless otherwise specified, non-dedicated electronic water level indicators shall be used to measure depth to water. The depth to groundwater will be measured using the groundwater measurement tube. The electronic water level indicators consist of a spool of graduated tape or small-diameter cable with a weighted probe attached to the end. When the probe comes in contact with the water, an electrical circuit is closed and a meter, light, and/or buzzer attached to the spool signals the contact. A depth to water measurement is read directly off the markings on the cable or tape. This method shall be used for obtaining accurate water level measurements. The following method will be used to measure groundwater elevation:

1. Verify well identification (ID). Check and ensure proper operation of measurement equipment aboveground. Prior to opening the well, don personal protective equipment as required.
2. Record well number, top of casing elevation, and surface elevation if available.
3. Lower the probe slowly into the well. Upon contact with water, the buzzer should sound and the indicator light should glow. Raise and lower the probe slightly about the water level a few times to determine accurate point of contact.

4. Measure and record static water level and total depth to the nearest 0.01 foot (0.3 cm.) from the surveyed reference mark on the top edge of the groundwater level measurement tube. If no reference mark is present, record in the logbook where the measurement was taken from (e.g., from the north side of the inner casing) and record the depth to groundwater.

5. Record the time and day of the measurement.

6. Raise the water level probe on the spool and decontaminate.

6.4 Equipment Calibration

The accuracy, precision, and usefulness of these measurements are dependent on the proper use and care of the field instruments. All meters shall be calibrated daily, prior to use in accordance with the manufacturer's directions. The instruments shall be handled carefully at the well site and during transport to the field and between sampling sites. All information regarding meter calibration shall be described in the field log book or field log form. All meters shall be used in accordance with the manufacturer's direction and no meters shall be used unless they are functioning properly. Equipment calibration procedures are outlined in the BQAPP.

6.5 Groundwater Purging

Groundwater monitoring wells will be purged prior to sampling to remove stagnant water in the well casing. Purging facilitates the collection of representative groundwater samples by promoting the movement of formation water into the well casing by removing stagnant water within the well. Once purging is complete, formation water will be collected for analysis.

Because of the potential for spreading environmental contamination, proper purge water disposal is a necessary part of well monitoring. All purge water shall be contained in an above-ground potable storage tank. Purge water collected at LF5 is temporally stored in above-ground storage tanks at the site pending the results of the analytical work. If the analytical results indicate that the samples are contaminated, the temporarily stored water is taken to the hazardous waste storage facility at Oasis for proper disposal; otherwise, the stored water is simply drained onto the ground.

Borehole volumes shall be calculated as described below. Calculations and the total purge volumes shall be entered in the field logbook or ground-water sampling log form.

1. Obtain all available information on well construction (e.g., location, casing, screen, total depth). This information is provided for the monitoring wells at LF5 in Table 2.

2. Determine well or casing diameter.

3. Measure and record static water level (depth below ground level or top of casing reference point).

4. Calculate the purge water volume using the following formula:

Total Purge Volume: $V_t = 3(V_c + V_a n) \times 7.48 \text{ gal/ft}^3$

where: V_t = Total Purge Volume (gals)

	V_c	=	Volume of water in well casing (ft^3)
	V_a	=	Volume of water in well annulus (ft^3)
	n	=	Estimated porosity of sand pack (usually 30%)
	7.48	=	Conversion factor from cubic feet to gallons

Casing Volume: $V_c = \pi r_1^2 h_1$

where:	V_c	=	Casing Volume (ft^3)
	r_1	=	Inside radius of monitoring well casing (ft)
	h_1	=	Height of water column (i.e., total well depth minus static water level depth) (ft)

Annular Volume: $V_a = \pi(r_2^2 - r_1^2) h_2$

where:	V_a	=	Annular Volume (ft^3)
	r_2	=	Radius of borehole (ft)
	r_1	=	Outside radius of well casing (ft)
	h_2	=	Total vertical saturated thickness of sand pack (ft)

Water level measurements, and water quality parameters including water level, pH, conductivity, and temperature shall be collected in the field during groundwater purging and sampling. The sensitivity of the water quality parameters to changes as a result of exposure of ground-water to surface level conditions (e.g., changes in the partial pressure of dissolved gases or the conditions of the purging system) make in-situ monitoring desirable. If possible, ground-water quality parameters measurement should be conducted in a closed cell attached to the discharge line of the pump system.

Pre-sampling purging will be considered complete when three borehole volumes have been evacuated from the well, and when three consecutive measurements (collected at least one-half a borehole volume apart) do not change by more than the following:

Conductivity	±10%
PH	±10%
Temperature	±10%

When evacuating low yield wells (wells that pump or bail dry) the well shall be evacuated to dryness once (USEPA, 1986, 1992). At no time shall the well be pumped or bailed dry if the recharge rate causes the formation water to vigorously cascade down the sides of the screen which may cause the loss of volatiles. Sampling shall be conducted when the well recovers to 90 percent of the pre-purge water column, with the following exceptions. If recovery exceeds sixteen hours, the sample shall be collected as soon as sufficient volume is available for a sample for each sample fraction. Wells shall not be allowed to recover overnight.

6.6 General Criteria for Sample Collection

- Once the purging of the well is complete, groundwater sampling will be conducted. All purging and sampling equipment shall be decontaminated prior to purging and sampling and between sampling locations (non-dedicated equipment). Temperature, pH, and specific conductance shall be measured immediately prior to and after sample collection. All ground-water sample data and information collected in the field shall be recorded in the field log book or on a field form.

Sample bottles shall be filled in order of the volatility of the analytes so that containers for analysis of volatile organic compounds will be filled first, and those for analyses that are not pH-sensitive or subject to loss of volatile components shall be filled thereafter. The sample collection order that shall be followed is based on USEPA guidance (USEPA, 1986) and is:

- VOCs
- Dissolved metals (beryllium, cadmium, chromium, and mercury)
- Sulfate and chloride
- Nitrate and ammonia

VOC Sample Collection Procedures

The following procedures shall be used for VOC sample collection:

The pump discharge will be reduced to 100 milliliters per minute (ml/min) or less.

The sample container shall be filled so that a convex meniscus forms over the neck of the opening to eliminate head-space. The cap will be filled with groundwater. The Teflon™ side of septum (in the vial cap) will be positioned against the meniscus, and he cap screwedon tightly. Invert the sample bottle and tap lightly to check for air bubbles. The absence of an air bubble indicates an airtight seal. If an air bubble is observed recollect the sample following the procedures described above. This process shall be continued until the sample for VOCs contains no head space.

Non-VOC Sample Collection Procedures

The following procedures shall be followed for collection of samples for analyses other than VOCs:

The pump discharge shall be reduced to minimize agitation or aeration of the sample. The sample containers shall be filled in order from the least to the most stable compounds as described previously. Sufficient volume shall be collected so that the scheduled analysis can be performed. The sample containers do not need to be filled to eliminate head-space.

6.7 Sample Handling and Shipment

6.7.1 Sample Containers

The sample containers to be used shall be dependent on the sample matrix and analyses desired. Unless specified otherwise by the project-specific work plan, the containers to be used for various analyses are described in Table 3. Sample containers shall be filled with adequate headspace (approximately 90 percent) for safe handling upon opening, except containers for volatile organic compound (VOC) analyses, which shall be filled completely with no headspace. This no-headspace requirement applies to both soil and ground-water samples.

Once opened, the containers shall be used immediately. If the container is used for any reason in the field (e.g., screening) and not sent to the laboratory for analysis, it shall be discarded. Prior to discarding the contents of the used container and the container, disposal requirements shall be evaluated. When storing before and after sampling, the containers shall remain separate from solvents and other volatile organic materials. Sample containers with preservatives added by the laboratory shall not be used if held for an extended period on the job site or exposed to extreme heat conditions. Containers shall be kept in a cool, dry place.

6.7.2 Numbering and Labeling

A sample label shall be affixed to all sample containers. Labels provided by the laboratory or another supplier may be used, and at a minimum shall include the following information:

- Client name, project title, or project location (sufficiently specific for data management)
- Sample location
- Sample identification number
- Date and time of sample collection
- Type of sample (grab or composite)
- Initials of sampler
- Preservative used
- Sample Analysis Method

This information shall be written in indelible ink. If a sample is split with another party, identical labels shall be attached to each sample container. After labeling, each sample shall be refrigerated or placed in a cooler containing wet ice to maintain sample temperature of 4 degrees Celsius (°C).

6.7.3 Chain-of-Custody

Chain-of Custody (CoC) procedures allow for the tracking of possession and handling of individual samples from the time of field collection through to laboratory analysis. Documentation of custody is accomplished through a CoC record that lists each sample and the individuals responsible for sample collection, shipment, and receipt. A sample is considered in custody if it is:

- In a person's possession.
- In view after being in physical possession.
- Locked or sealed so that no one can tamper with it after it has been in an individual's physical custody.
- In a secured area, restricted to authorized personnel.
- A CoC record is used to record the samples taken and the analyses requested. Information recorded includes time and date of sample collection, sample number, and the type of sample, the sampler's signature, the required analysis, and the type of containers and preservatives used. The sampler shall retain a copy of the CoC record prior to release to a second or third party.

CoC records shall be placed in a plastic bag, secured to the lid of the cooler, and transported with the samples. When the sample(s) are transferred, both the receiving and relinquishing individuals shall sign the record. Signed airbills shall serve as evidence of custody transfer between the field sampler and courier as well as courier and laboratory. If a carrier service is used to ship the samples (e.g., Federal Express), custody shall remain with the sampler until it is relinquished to the laboratory. The sampler shall retain copies of the CoC record and airbill. If the CoC records are sequentially numbered, the record number and airbill number shall be cross-referenced in the field logbook.

6.7.4 Sample Preservation/Storage

The requirements for sample preservation are dependent on the desired analyses and the sample matrix. Unless otherwise specified by the project plan, sample preservation requirements will be performed as required by the analytical method. Sample preservation is summarized in Table 3.

6.7.5 Custody Seals

Custody seals shall be used on each shipping container to ensure custody. Custody seals consist of security tape with the initials of the sampler and the date placed over the lid of each cooler containing samples. The tape shall be affixed such that the seal must be broken to gain access to the contents. Custody seals shall not be placed directly onto the VOC sample bottles. Custody seals shall be placed on coolers prior to the sampling team's release to a second or third party (e.g., shipment to the laboratory).

6.7.6 Sample Shipping

Procedures for packaging and transporting samples to the laboratory are based on the actual chemical, physical, and hazard properties of the material. The procedures may also be based on an estimation of contaminant concentrations/properties in the samples to be shipped. Samples shall be identified as either environmental samples, excepted quantities samples, limited quantities samples, or standard hazardous materials. Environmental samples are defined as solid or liquid samples collected for chemical analysis.

Excepted quantities involve the shipment of a few milliliters of either an acid or base preservative in an otherwise empty sample container. Limited quantities are restricted amounts of hazardous materials that may be shipped in generic, sturdy containers. Standard hazardous material shipments require the use of stamped/certified containers. All samples shall be packaged and shipped or hand delivered to the laboratories the same day of sample collection, unless otherwise specified in the project work plans.

6.7.6.1 Sample Shipping via Commercial Carrier

All samples shall be packaged and shipped to the laboratories the same day of sample collection, unless otherwise specified in the project work plans. For aqueous or solid samples that are shipped to the Contract Laboratory via a commercial carrier, the following procedures apply:

- Sample labels shall be completed and attached to sample containers as described in Section 6.7.2.
- The samples shall be placed upright in a waterproof metal (or equivalent strength plastic) ice chest or cooler.
- Wet ice in double Ziploc™ bags (to prevent leakage) shall be placed around, among, and on top of the sample bottles. Enough ice shall be used so that the samples shall be chilled and maintained at 4°C (± 2°C) during transport to the laboratory. Dry ice shall not be used. In addition, experience has shown that blue ice is inadequate.
- To prevent the sample containers from shifting inside the cooler, the remaining space in the cooler shall be filled with inert cushioning material, such as shipping peanuts, additional bubble pack, or cardboard dividers.
- The original copy of the completed CoC Form shall be placed in a waterproof plastic bag and taped to the inside of the cooler lid.
- The lid shall be secured by wrapping strapping tape completely around the cooler in two locations.
- “This Side Up” labels shall be placed on two sides of the cooler.
- Custody seals shall be placed in two locations (the front right and back left of the cooler) across the cooler closure to ensure that any tampering is detected. The date and initials of the sampler shall be written on the custody seal.

A copy of the CoC record and the signed air bill shall be retained for the project files.

6.7.6.2 Hand-Delivered Samples

For groundwater samples that will be hand carried to the Contract Laboratory the following procedures apply:

- Sample labels shall be completed and attached to sample containers as described in Section 6.7.2.

- The samples shall be placed upright in a waterproof metal (or equivalent strength plastic) ice chest or cooler.
- Wet ice in double Ziploc™ bags (to prevent leakage) shall be placed around, among, and on top of the sample bottles. Enough ice shall be used so that the samples will be chilled during transport to the laboratory.
- To prevent the sample containers from shifting inside the cooler, the remaining space in the cooler shall be filled with inert cushioning material, such as shipping peanuts, additional bubble pack, or cardboard dividers.
- The original copy of the completed CoC Form shall accompany the samples to the laboratory.

A copy of the CoC record shall be retained for the project files.

6.8 Equipment Decontamination

6.8.1 Sampling Equipment

The following procedure will be used to decontaminate non-dedicated sampling equipment that may come into contact with groundwater samples. To minimize decontamination procedures in the field, dedicated equipment shall be used wherever feasible. The following procedure will be used to decontaminate non-dedicated equipment:

- Wash and scrub equipment with phosphate-free laboratory-grade detergent (e.g., Alconox™ or equivalent); steam cleaning may also be performed if possible
- Rinse with distilled water
- Triple-rinse with distilled water

Personnel involved in decontamination activities shall wear appropriate protective clothing as defined in the project-specific health and safety plan.

6.9 Data Management

Data management tasks associated with this project will include the transfer of electronic data between analytical laboratories and the data manager, the data manager and the data validation staff, and the data manager and HAFB data manager. To facilitate smooth data flow, the Air Force Environmental Resources Program Information Management System (ERPIMS) will be used as the basis for data management. The ERPIMS format provides a set of codes and structure for data deliverables. Data management will be performed in the following sequence:

- The field sampling team will obtain samples according to the BQAPP, unless otherwise noted, in locations defined in this Attachment.
- The samples obtained during the day will be continuously logged on a CoC form.
- The CoCs will be delivered to the data manger who will enter the data from the CoCs to the database. The data manager can then track the status of the analytical samples.

6.10 Data Validation

All analytical laboratory data will be validated according to EPA protocols. Validated data will be included in all reports. The Analytical Laboratory will review all validation reports prior to completion of the validation process. Upon completion of the validation process, the analytical data and reports will be transmitted electronically to the data manager. The validated data will then be re-entered into the project database.

6.11 Statistical Approach for Groundwater Analysis

The Mann-Kendall statistical test will be applied to the analytical data to determine the occurrence of increasing concentrations over time. The Mann-Kendall test is a non-parametric test that is suitable for non-normal data sets. The test will be performed at the 95-percent confidence level and will be applied to both the control and compliance well data sets. The Z score calculated for each data set is compared to the expected Z score at the 95-percent confidence interval. If the calculated Z score exceeds the expected Z score, the occurrence of an upward trend in concentration will be indicated.

TABLE 1
Analytical Methods
Landfill #5 Groundwater Sampling

Parameter	USEPA Method Listed in Closure/Post Closure Plan	USEPA Methods Used by USGS in 2000	Updated USEPA Method
Organics			
Volatile Organic Compounds	E601(SW8010)/SW8020	SW8260A/8260B	SW8260B
Common Ions			
Bicarbonate (HCO3) Alkalinity (CaCO3)	A403	E310.1	E310.1
Chloride	A429	E300.0A	E300.0A
Nitrate/Nitrate-Nitrite	A429	E353.2	E353.2
Sulfate	A429	E300.0A	E300.0A
Total Dissolved Solids	E160.1	E160.1	E160.1
Dissolved Metals			
Cadmium	SW6010	SW6010B	SW6010B
Beryllium	SW6010	SW6010B	SW6010B
Chromium	SW6010	SW6010B	SW6010B
Mercury		SW7470/7470A	SW7470A
Field Measurements			
Specific Conductance	Field Test	Field Test	Field Meter
pH	Field Test	Field Test	Field Meter
Temperature	Field Test	Field Test	Field Meter

TABLE 2
Landfill #5 – Monitoring Well Data

Boring Number	Date Drilled (feet)	Total Depth (feet)	Approx. Water Level (feet)	Boring Diameter (inches)	Screen Interval (feet)	Casing/ Screen Diameter (inches)	Casing/ Screen Type	Pump Type	Intake Depth (feet)	Discharge Piping	Water Level Access Piping	Control Box	Date of Latest Pump Replace-ment
E	Oct-86	460	396.6	8-5/8	425-445	4	Sch. 40 PVC	Grundfos 5S15-26	432	1-inch Sch. 80 PVC, NPT Thread	3/4-inch Flush Threaded Sch. 80 PVC	Yes	Jul-98
F	Oct-86	521	453.75	8-5/8	485-505	4	Sch. 40 PVC	Grundfos 5S15-26	482	3/4-inch Sch. 40 PVC, NPT Thread	3/4-inch Flush Threaded Sch. 80 PVC	Yes	Jul-97
G	Jan-88	504	415.25	8-5/8	435-455	4	Sch. 40 PVC	Grundfos 5S15-26	452	3/4-inch Sch. 40 PVC, NPT Thread	3/4-inch Flush Threaded Sch. 80 PVC	Yes	Jan-98
H	Jan-88	450	389	8-5/8	414-434	4	Sch. 40 PVC	Grundfos 5S15-26	?	1-inch Sch. 40 PVC, NPT Thread	3/4-inch Flush Threaded Sch. 80 PVC	No	Jan-93
I	Feb-88	460	385	8-5/8	425-445	4	Sch. 40 PVC	Grundfos 5S15-26	442	1-inch Sch. 40 PVC, NPT Thread	3/4-inch Flush Threaded Sch. 80 PVC	Yes	Mar-97
J-1	Sep-96	442	383.5	7-7/8	420-440	4	Sch. 40 PVC	Grundfos 5S15-26	425	3/4-inch Type 304 SS	3/4-inch Flush Threaded Sch. 80 PVC	Yes	Sep-96

TABLE 3
Analytical Method, Sample Container, Preservative, Unit of Measure, and Holding Time Criteria

Analytical Method	Sample Container	Preservative	Unit of Measure	Holding Time
Water				
VOCs (SW-846 8021B, 8015B pursuable 8260B, USEPA 601, 602, 624)	2 40-ml amber glass bottles with a Teflon™ septum cap; No head space	HCL; pH < 2 Chill to 4°C	µg/l	14 days from sample collection to analysis
Metals (except mercury) (SW-846 6010B,	1-liter polyethylene bottle with a Teflon™ lined cap	HNO_3; pH < 2 Chill to 4°C	µg/l	180 days from sample collection to analysis
Mercury (SW-846 7470A, USEPA 245.1)	1-liter polyethylene bottle with Teflon™ lined cap	HNO_3; pH < 2	µg/l	28 days from sample collection to analysis
Hexavalent-Chromium (SW-846 7196A)	100-ml polyethylene bottle with Teflon™ lined cap	Chill to 4°C	µg/l	24 hours from sample collection to analysis
Chloride (USEPA 300.0)	250-ml polyethylene bottle with a Teflon™ lined cap	Chill to 4°C	mg/l	28 days from sample collection to analysis
Sulfate (USEPA 300.0)	100-ml polyethylene bottle with a Teflon™ lined cap	Chill to 4°C	mg/l	28 days from sample collection to analysis
Nitrite/Nitrate (USEPA 353.2)	250-ml polyethylene bottle with a Teflon™ lined cap	H_2SO_4; pH < 2 Chill to 4°C	mg/l	28 days from sample collection to analysis
Alkalinity (USEPA 310.1)	250-ml polyethylene bottle with a Teflon™ lined cap	Chill to 4°C	mg/l	14 days from sample collection to analysis
Total Dissolved Solids (USEPA 160.1)	250-ml polyethylene bottle with a Teflon™ lined cap	Chill to 4°C	mg/l	7 days from sample collection to analysis

FIGURE 1
Landfill 5 Location Map

FIGURE 2
Monitoring Well Location Map